Title	**Sena UPS Serial Protocol**
No.	

Rev.	Date	By	History
0.0.1	2003-4-18	UIS	Initial draft
0.0.2	2003-5-2	KCY	revision
	2003-5-21	KSW	English translation

Table of Contents

1. Overview

This document covers the UPS serial protocol provided by the UPSLink100 product. Users may refer to **"UPS serial programming guide"** and the source code of the UPS management sample program using this protocol for programming their own UPS program.

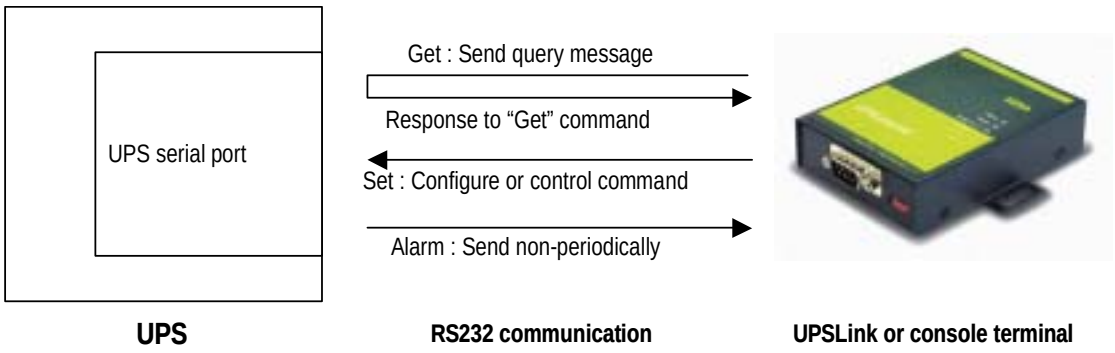
The UPSLink serial protocol is designed enhancing the RFC1628 standard, "UPS Management Information Base".

The whole right for the ownership and the intellectual property of this protocol is subject to Sena Technologies Inc. Without Sena Technologies' approval, no one can use this protocol in their products.

1.1. Communication

The protocol is character-based protocol, and the communication messages are classified as follows.

- Get : Query to the UPS from the UPSLink to get the status information of the UPS
- Response : Response from the UPS to the UPSLink
- Set : Command from the UPSLink to the UPS to change the current status of the UPS or to control it
- Alarm : Emergency messages from the UPS to the UPSLink, which are non-periodic.



Picture 1-1 Communication message type

2. Variables

Each variable used in the serial protocol is one-to-one correspondent to that of the RFC1628 UPS MIB variable.

Variable	Group	Unit & Range	Variable in RFC1628
Manufacturer	Identification	String, Max. 31bytes	upsIdentManufacturer
Model		String, Max. 63bytes	upsIdentModel
UPSSoftwareVersion		String, 63bytes	upsIdentUPSSoftwareVersion
AgentSoftwareVersion		String, Max. 63bytes	upsIdentAgentSoftwareVersion
IdentName		String, Max. 63bytes	upsIdentName
AttachedDevices		String, Max. 63bytes	upsIdentAttachedDevices
BatteryStatus	Battery	1 : unknown 2 : batteryNormal 3 : batteryLow 4 : batteryDepleted	upsBatteryStatus
SecondsOnBattery		sec	upsSecondsOnBattery
EstimatedMinutesRemaining		min	upsEstimatedMinutesRemaining
EstimatedChargeRemaining		%(0~100)	upsEstimatedChargeRemaining
BatteryVoltage		Volts DC	upsBatteryVoltage
BatteryCurrent		Amp DC	upsBatteryCurrent
BatteryTemperature		degree (celcius)	upsBatteryTemperature
InputLineBads	Input	# of units	upsInputLineBads
InputNumLines		# of units (1~3)	upsInputNumLines
InputFrequency1~3		Hz	upsInputFrequency
InputVoltage1~3		RMS volts	upsInputVoltage
InputCurrent1~3		RMS amps	upsInputCurrent
InputTruePower1~3		Watts	upsInputTruePower
OutputSource	Output	1 : other 2 : none 3 : normal 4 : bypass 5 : battery 6 : booster 7 : reducer	upsOutputSource
OutputFrequency		Hz	upsOutputFrequency
OutputNumLines		# of units (1~3)	upsOutputNumLines
OutputVoltage1~3		RMS volts	upsOutputVoltage

OutputCurrent1~3		RMS amps	upsOutputCurrent
OutputPower1~3		Watts	upsOutputPower
OutputPercentLoad1~3		Percent (0~200)	upsOutputPercentLoad
BypassFrequency	Bypass	Hz	upsBypassFrequency
BypassNumLines		# of units (1~3)	upsBypassNumLines
BypassVoltage1~3		RMS volts	upsBypassVoltage
BypassCurrent1~3		RMS amps	upsBypassCurrent
BypassPower1~3		Watts	upsBypassPower
BatteryBad	Alarm	1: Generated, 0 Cleared	upsAlarmBatteryBad
OnBattery			upsAlarmOnBattery
LowBattery			upsAlarmLowBattery
DepletedBattery			upsAlarmDepletedBattery
TempBad			upsAlarmTempBad
InputBad			upsAlarmInputBad
OutputBad			upsAlarmOutputBad
OutputOverload			upsAlarmOutputOverload
OnBypass			upsAlarmOnBypass
BypassBad			upsAlarmBypassBad
OutputOffAsRequested			upsAlarmOutputOffAsRequested
UpsOffAsRequested			upsAlarmUpsOffAsRequested
ChargerFailed			upsAlarmChargerFailed
UpsOutputOff			upsAlarmUpsOutputOff
UpsSystemOff			upsAlarmUpsSystemOff
FanFailure			upsAlarmFanFailure
FuseFailure			upsAlarmFuseFailure
GeneralFault			upsAlarmGeneralFault
DiagnosticTestFailed			upsAlarmDiagnosticTestFailed
CommunicationsLost			upsAlarmCommunicationsLost
AwaitingPower			upsAlarmAwaitingPower
ShutdownPending			upsAlarmShutdownPending
ShutdownImminent			upsAlarmShutdownImminent
TestInProgress			upsAlarmTestInProgress
TestId	Test	1 : upsTestNoTestsInitiated 2 : upsTestAbortTestInProgress 3 : upsTestGeneralSystemsTest 4 : upsTestQuickBatteryTest 5 : upsTestDeepBatteryCalibration	upsTestId

ResultsSummary		1 : donePass 2 : doneWarning 3 : doneError 4 : aborted 5 : inProgress 6 : noTestsInitiated	upsTestResultsSummary
ResultsDetail		String, Max. 255bytes	upsTestResultsDetail
ShutdownType	Control	1 : output 2 : system	upsShutdownType
ShutdownAfterDelay		sec (-1~2147483648)	upsShutdownAfterDelay
StartupAfterDelay		sec (-1~2147483648)	upsStartupAfterDelay
RebootWithDuration		sec (-1~300)	upsRebootWithDuration
AutoRestart		1 : on 2 : off	upsAutoRestart
ConfigInputVoltage	Configuration	RMS volts	upsConfigInputVoltage
ConfigInputFreq		Hz	upsConfigInputFreq
ConfigOutputVoltage		RMS volts	upsConfigOutputVoltage
ConfigOutputFreq		Hz	upsConfigOutputFreq
ConfigOutputVA		Volt-amps	upsConfigOutputVA
ConfigOutputPower		Watts	upsConfigOutputPower
LowBattTime		min	upsConfigLowBattTime
AudibleStatus		1 : disabled 2 : enabled 3 : muted	upsConfigAudibleStatus
LowVoltageTransferPoint		RMS volts	upsConfigLowVoltageTransferPoint
HighVoltageTransferPoint		RMS volts	upsConfigHighVoltageTransferPoint

Note : The gray-colored variables in the table are the ones that the unit of which is different from that of RFC1628 UPS MIB variables.

3. Messaging

3.1. Message format

The message format is shown as follows.

Header	Type	Length	Command	Data_1	Delimiter	Data_2	Delimiter	.....	Delimiter	Data_n	Footer
1byte	3bytes	3bytes	3bytes								3bytes

- Header : 1 byte character '#' (0x23)
- Type : One of the types described in section *1.1 Communication*.
  Get : "GET"
  Response : "RSP"
  Set : "SET"
  Alarm : "ALM"
- Length : The whole length of the message starting from the "Command" field to the end of "Footer" field, excluding the fields of "Header", "Type".
  For example, if the length of the message is 6 bytes, the field should be set as "006". If 135 bytes, set the field as "135".
- Command : Command type. The detailed description on this field is covered in section. *3.2. Message Description*. Please see the section for further information. In case of "Alarm" message, this field will be filled with 3 byte space characters, " ".
- Data_1, Data_2,… Data_n : These fields contain **n** data fields discriminated by the delimiter. Please see details in the section. *2. Variables* for further information on the variables. Id there's no data required such as "Get" command, the data field is not necessary.
- Delimiter : Delimiter between each data field. 1 byte character, comma, "," (0x2c).
- Footer : The field showing the end of the message. It is 3 byte String "END".

3.2. Message Description

Get

There is no "Data" field within the "Get" command.

Ex) #GET006UIDEND

Command	Description	RFC1628 command
UID	Get UPS Identification information	upsIdent
BAT	Get Battery information.	upsBattery
INP	Get Input information.	upsInput

OUT	Get Output information	upsOutput
BYP	Get Bypass information	upsBypass
ALM	Get Alarm information	upsAlarm
TST	Get Test information	upsTest
CTR	Get Control information	upsControl
CFG	Get Configuration information	upsConfig

Response

Response is the response to the “Get” command. The UPS status variables should be included in the “Data” field.

Ex) #RSP043UIDSena,DEMO,1.0.15,2.0.0,UPSLink,RouterEND

Command	Description & Data	RFC1628 command
UID	Response from GET-UID	upsIdent
	Manufacturer, Model, UPSSoftwareVersion, AgentSoftwareVersion, IdentName, AttachedDevices	
BAT	Response from GET-BAT	upsBattery
	BatteryStatus, SecondsOnBattery, EstimatedMinutesRemaining, EstimatedChargeRemaining, BatteryVoltage, BatteryCurrent, BatteryTemperature	
INP	Response from GET-INP	upsInput
	InputLineBads, InputNumLines, InputFrequency1, InputVoltage1, InputCurrent1, InputTruePower1, InputFrequency2, InputVoltage2, InputCurrent2, InputTruePower2, InputFrequency3, InputVoltage3, InputCurrent3, InputTruePower3	
OUT	Response from GET-OUT	upsOutput
	OutputSource, OutputFrequency, OutputNumLines, OutputVoltage1, OutputCurrent1, OutputPower1, OutputPercentLoad1, OutputVoltage2, OutputCurrent2, OutputPower2, OutputPercentLoad2, OutputVoltage3, OutputCurrent3, OutputPower3, OutputPercentLoad3	
BYP	Response from GET-BYP	upsBypass
	BypassFrequency, BypassNumLines, BypassVoltage1, BypassCurrent1, BypassPower1, BypassVoltage2, BypassCurrent2, BypassPower2, BypassVoltage3, BypassCurrent3, BypassPower3	
ALM	Response from GET-ALM	upsAlarm

	BatteryBad, OnBattery, LowBattery, DepletedBattery, TempBad, InputBad, OutputBad, OutputOverload, OnBypass, BypassBad, OutputOffAsRequested, UpsOffAsRequested, ChargerFailed, UpsOutputOff, UpsSystemOff, FanFailure, FuseFailure, GeneralFault, DiagnosticTestFailed, CommunicationsLost, AwaitingPower, ShutdownPending, ShutdownImminent, TestInProgress	
TST	Response from GET-TST	upsTest
	TestId, ResultsSummary, ResultsDetail	
CTR	Response from GET-CTR	upsControl
	ShutdownType, ShutdownAfterDelay, StartupAfterDelay, RebootWithDuration, AutoRestart	
CFG	Response from GET-CFG	upsConfig
	ConfigInputVoltage, ConfigInputFreq, ConfigOutputVoltage, ConfigOutputFreq, ConfigOutputVA, ConfigOutputPower, LowBattTime, AudibleStatus, LowVoltageTransferPoint, HighVoltageTransferPoint	

Set

"Set" command is the one that controls the UPS variables. The related Data field will be required in the message.

Ex) #SET012NAMMy UPSEND

Command	Description & Data	RFC1628 command
NAM	Configure the name of UPS	upsIdentName
	IdentName	
ATD	Configure the device attached to UPS	upsIdentAttachedDevices
	AttachedDevices	
TID	Perform Test	upsTestId
	TestId	
SDT	Configure the type of the shutdown operation	upsShutdownType
	ShutdownType	
ARS	Configure the type of the reboot operation	upsAutoRestart
	AutoRestart	
SDA	Shutdown the UPS after pre-defined time is elapsed,	upsShutdownAfterDelay
	ShutdownAfterDelay	
SUA	Start the UPS after pre-defined time is elapsed,	upsStartupAfterDelay
	StartupAfterDelay	
RWD	Reboot the UPS after pre-defined time is elapsed,	upsRebootWithDuration
	RebootWithDuration	

CIV	Configure the normal input voltage	upsConfigInputVoltage
	ConfigInputVoltage	
CIF	Configure the normal input frequency	upsConfigInputFreq
	ConfigInputFreq	
COV	Configure the normal output voltage	upsConfigOutputVoltage
	ConfigOutputVoltage	
COF	Configure the normal output frequency	upsConfigOutputFreq
	ConfigOutputFreq	
CLB	Configure the battery limit time	UpsConfigConfigLowBattTime
	LowBattTime	
CAS	Configure the audible emergency status	upsConfigAudibleStatus
	AudibleStatus	
CLT	Configure the minimum input voltage to switch into battery mode	UpsConfigLowVoltageTransferPoint
	LowVoltageTransferPoint	
CHT	Configure the maximum input voltage to switch into battery mode	UpsConfigHighVoltageTransferPoint
	HighVoltageTransferPoint	

Alarm

If there are any incoming alarm messages from the UPS, the message is transferred to the UPSLink.

Ex) #ALM011PRE2,3,7END

Command	Description
PRE	There is incoming alarm message
	The index of the alarm message
REL	There is incoming alarm cleared message
	The index of the alarm message

The index of the alarm message is described as follows.

Index	Alarm	Index	Alarm
1	BatteryBad	13	ChargerFailed
2	OnBattery	14	UpsOutputOff
3	LowBattery	15	UpsSystemOff
4	DepletedBattery	16	FanFailure
5	TempBad	17	FuseFailure
6	InputBad	18	GeneralFault
7	OutputBad	19	DiagnosticTestFailed

8	OutputOverload	20	CommunicationsLost
9	OnBypass	21	AwaitingPower
10	BypassBad	22	ShutdownPending
11	OutputOffAsRequested	23	ShutdownImminent
12	UpsOffAsRequested	24	TestInProgress

4. Example

To send query message asking the input status of the UPS, use

```
#GET006INPEND
```

```
#       - Header
GET     - Query
006     - 6 byte length
INP     - Input status
END     - Footer
```

The corresponding response from the UPS should be

```
#RSP040INP0,1,60,210,90,4000,0,0,0,0,0,0,0,0END
```

```
#       - Header
RSP     - response
040     - 40 byte length
INP     - Input status
0       - InputLineBads
1       - InputNumLines
60      - InputFrequency1
210     - InputVoltage1
90      - InputCurrent1
4000    - InputTruePower1
0       - InputFrequency2
0       - InputVoltage2
0       - InputCurrent2
0       - InputTruePower2
0       - InputFrequency3
0       - InputVoltage3
0       - InputCurrent3
0       - InputTruePower3
END     - Footer
```

To send query message asking the alarm status of the UPS, use

```
#GET006ALMEND
```

The corresponding response from the UPS should be

```
#RSP053ALM0,1,1,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0END
```

Data fields : 0,**1**,**1**,0,0,0,0,**1**,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

The alarms, the index of which is 2, 3 and 8 generated, and others are cleared
(OnBattery, LowBattery and OutputOverload alarm messages are generated)

To send query message asking the test items of the UPS, use

```
#GET006TSTEND
```

The corresponding response from the UPS should be

```
#RSP061TST3,1,General system test has been finished with no errorEND
```

Data fields : 3,1,General system test has been finished with no error

3 - TestId : upsTestGeneralSystemsTest
1 - ResultsSummary : donePass
General system test has been finished with no error - ResultsDetail

To configure the name of the device attached to the UPS as “Router”, use

#SET012ATDRouterEND

To perform the instant battery test, use

#SET007TID4END

To reboot the UPS after 600sec, use

#SET009RWD600END

To configure the normal input frequency of the UPS as 63Hz, use

#SET008CIF63END

To activate audible alarm signal, use

#SET007CAS2END

When there are incoming alarm messages of LowBattery and OnBypass from the UPS, the following message should be arrived to the UPSLink.

#ALM009PRE3,9END

When the alarm status of LowBattery and OnBypass is cleared, the following message should be arrived to the UPSLink.

#ALM009REL3,9END